Simplified Turbidity Current Process Models as Tools in Deep-Water Exploration, Appraisal, and Development

JT Eggenhuisen
Utrecht University

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Exploration, appraisal, and development in deep marine sedimentary systems depends on management decisions based on amalgamated information from diverse datasets, analyses, and workflows. One particular type of approach that often fails to make meaningful contributions to decision-making is physics-based modelling of sediment transport processes. This despite the promise that there lies true power in understanding how nature has constructed depositional bodies, grain-by-grain, through the action of water and gravity. I here argue that this failure to deliver on the promise can be caused by the wrong preference for model type by scientists and industry professionals. The error that is commonly made, is that more complex model approaches are deemed better, while they are in fact unfit for purpose. Subsurface deepwater depositional systems are inherently sparse-data systems. The purpose of a modelling exercise in this context must be to supply usefull quantitative constraints that can be combined with seismic data, well-data, basin context, and analogues. Lack of understanding of a deepwater system can never be resolved by using a more complex modelling system. On the contrary, more complex models tend to have more variables, with more intricate interactions. They therefore require operators to set more intricate and precise boundary conditions, i.e. to be more knowledgeable about the system a priori than they can reasonably be. The models presented here, have purposefully been reduced in complexity, so that they can serve as a robust check of a system's range of geological parameters. Yet they still encapsulate our state-of-the-art process-understanding of turbulent sediment transport in

turbidity currents. The results explicitly quantify the uncertainty in predicted parameters (e.g. sand volume) as a consequence of geological uncertainty. This is the only way to make physics-based modelling contribute to stochastic assessments in hydrocarbon industry. In this presentation I will show two models that exemplify this philosophy. A model of channelized turbidity currents is used to investigate down-dip sand volume predictions from channel cross-sections. The results show that the geological model that connects hierarchical scales to the channel form traversed by the turbidity flow is key for correct assessment of the sand volume. A model for the depletion of turbidity currents in lobe elements demonstrates how planform dimensions and volumes of lobes can be estimated to support parallel seismic analyses, in which the thinning edges of lobes are typically poorly imaged.

AAPG Datapages/Search and Discovery Article # 91200 © 2020 AAPG Annual Convention & Exhibition Online, Sept. 29- Oct. 1.